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BULLETIN NO. 94.

A—COMPOSITION OF THE RAMIE PLANT.
B—FERTILIZING VALUE OF GREASEWOOD.

COMPOSITION OF THE RAMIE PLANT.

In Bulletin No. 90 ("Fiber Plants for California," June 23, 1891) special mention is made of the exhaustion of the soil by the production of ramie. The object of the present investigation is to show the actual amounts of mineral ingredients withdrawn from the soil by the different parts of the plant, and to point out the great necessity of returning to the soil the leaves and stalks after decortication.

Experiments on a small plot upon the University grounds, and on a much larger scale by M. Goncet de Mas at Padua, Italy, have proved that on good soils where from three to four cuts can be made annually, the yield will be about ten tons of dried stalks per acre. M. Goncet de Mas, in the third year after planting, obtained from two cuts nearly nine tons of dried stalks. We are told by Mr. McAfee of Bakersfield that the best fiber is produced when three instead of four cuts are made annually. The total yield of the three will not differ materially from that of the four cuts; the weight of each cut in the former case being proportionately heavier. The tables given below, showing the total amounts withdrawn from the soil, are based upon these figures.

Separate analyses were made of the ashes of the leaves, stalks without bark, and bark, *i. e.*, cuticle and fiber, including gum. The cuticle and fiber were analyzed together because, while the leaves and stalks can be readily returned to the soil, it will hardly be feasible to do so with the cuticle and gum; and, as stated above, our present object is to ascertain what can and what cannot be given back to the soil.

PROXIMATE COMPOSITION OF THE PLANT.

It is found that five tons of wet or fresh stalks are equivalent to one of dry.

We find that the leaves constitute about 30 per cent of the dried plant; the decorticated stalk 51 per cent and the bark 19 per cent. Of the latter nearly 15 is raw fiber, containing 30 per cent of gum, thus making the percentage of pure fiber in the plant as grown here, about 11.

Referred to stalk, *without leaves* as 100, the results are as follows: Decorticated stalk 73 per cent, whole bark 27, of which 6 is cuticle, and 21 decorticated fiber with gum. Thus the proportion of pure fiber referred to stalk alone is about 15 per cent.

CHEMICAL COMPOSITION OF THE PLANT AND ITS ASH.

Table I. shows the proximate composition of

the different parts of the plant, and also the results of the analyses of the ash of the several parts.

TABLE I.

Proximate Analysis of the Ramie Plant.

	Whole plant.	Stalk.*	Bark.†	Leaves.
Water	81.26	81.75	80.91	80.65
Organic matter	17.25	17.68	18.78	15.54
Ash	1.49	.57	31	3.81
Total	100.00	100.00	100.00	100.00
Ash in dry substance	7.950	3.120	1.620	19.690
Nitrogen in fresh plant	.258	.146	.210	.481
Albuminoids in fresh plant	1 612	.912	1.312	3 006

Analysis of the Ash.

	Whole plant.	Stalk	Bark.	Leaves
Potash (K_2O)	11.82	37 79	32.58	4 18
Soda (Na_2O)	2 35	8 15	8 77	.54
Lime	30.87	17.32	22.28	34 74
Magnesia	7.89	10.58	11.64	7.02
Ferric oxide and alumina	2 41	2.95	.84	2 35
Br. oxide manganese	.17	.35	.18	.12
Phosphoric acid (P_2O_5)	7.29	16.38	12.64	4.72
Sulphuric acid (SO_3)	2.26	3.46	3 68	1.88
Silica	33.01	1.56	5 24	42.42
Chlorine	2.43	1.87	2.75	2 55
	100.50	100.41	100 60	100.52
Less excess of oxygen due to chlorine	.50	.41	.60	.60
Total	100.00	100 00	100.00	99.92

* Stalk without bark.
† Including fiber and gum.

An inspection of the figures representing the percentage in the ash of the whole plant shows that *lime* is the most abundant ingredient, being 30.87 per cent; next comes *potash* with 11.82 per cent, while that of *phosphoric acid* is only about one fourth that of lime, viz., 7.3 per cent.

In the ash of the *leaves*, also, by far the most prominent ingredient of plant-food is lime forming a little more than one-third of of the whole ash; potash and phosphoric acid amounting to less than 5 per cent each. The predominating element in the ashes of the *stalk* and *bark* on the contrary is *potash*, being in the former case more than 37 per cent., and in the latter almost one-third of the weight of the ash; thus indicating the heavy draught made on the soil in this respect. The percentages of phosphoric acid in the stalk and bark are nearly 3.5 and 2.5 times, respectively, that contained in the leaves. Lime, while not present in such large quantities as in the leaves, still occupies a very prominent place among the ash ingredients of all parts, the stalk containing 17.32 per cent, and the bark 22.38 per cent.

In considering the relative values of the different ashes it must not be forgotten that although the figures given represent pounds per hundred of the *ash*, it will require a very much smaller quantity of the *leaves* to make 100 pounds of ash than is the case with either stalk or bark. Thus, about 500 pounds of dried leaves will yield 100 pounds of ash; but 3,200 pounds of dried stalks and 6,200 pounds bark will be necessary to produce the same amount of ash.

In table 2 are shown more clearly the fertilizing values of the ashes of the different parts of the plant; it presents the amounts of mineral ingredients actually withdrawn from the soil per acre. It is calculated for a crop of ten tons of dried stalks per acre and, of course, where the yield is not so large, the draft upon the soil is proportionately less.

TABLE 2.

Amount in pounds, of soil ingredients withdrawn from one acre annually, by four cuts of ramie yielding a total of ten tons of dried stalks, and four and one-quarter tons of leaves.

Per acre. Tons.	Whole plant 14¼	Stalk 7¼	Bark 2¾	Leaves 4¼
	lbs.	lbs.	lbs.	lbs.
Potash (K_2O)	251.98	155.99	27.86	68.13
Soda (Na_2O)	50 14	33.63	7.52	8.99
Lime	657.82	71.77	19.14	566.91
Magnesia	168.27	43.68	10 01	114.58
Ferric Oxide and Alumina	51.43	12.16	0 71	38 56
Manganese oxide	3.57	1.45	0.20	1.92
Phosp'ic acid (P_2O_5)	155.70	67 71	10.86	77.13
Sulph. acid (SO_3)	48.56	14.53	3.17	30.86
Silica	704.25	7.06	4.48	692 71
Chlorine	51.85	2.50	7.79	41.56
Nitrogen	369.70	105.85	57.75	206.10

A consideration of the data given in the table proves to what an alarming extent the soil would be depleted by a continuous culture of ramie when nothing is returned; as no soil, no matter how rich originally, could long withstand such a great strain upon its resources.

The total amount of mineral ingredients withdrawn by a single crop (four cuts) is 2143 pounds, which must be considered as permanently removed when neither the leaves nor the stalks are used as fertilizing materials. The draught made on lime is about 658 pounds, on potash 252 pounds, phosphoric acid 156, and on nitrogen to the extent of 370 pounds, per acre. Of the potash about three-fifths, or 156 pounds, is contained in the stalks, more than one quarter, or 68 pounds, in the leaves, while the bark and fiber, the only production aimed at, contains a little above one-tenth, or 28 pounds, of the total amount.

The leaves contain nearly 87 per cent of the total lime taken from the soil, that found in the stalk being about 10 and that in the bark 3 per cent.

Of the total pho phoric acid withdrawn, the leaves absorb almost 50 per cent or 77 pounds, the stalk 43 per cent or about 68 pounds, while only 7 per cent or 10.86 pounds, is found in the bark.

The depletion of the soil in nitrogen is greatest through the leaves, which have more than 55 per cent of the total, or 206 pounds; about 29 per cent or 106 pounds is found in the stalks, while in the bark there is only 15 per cent, or about 58 pounds.

It will thus be seen how very small is the proportion of plant food withdrawn by the bark and fiber, as compared with that by the leaves and stalks; and since the fiber is beyond compaison the most valuable product sought, it is obvious that its continuous production should above all be assured.

The ingredients first to be exhausted by such a continuous culture would, in all probability be phosphoric acid and nitrogen, owing to the fact that so many of the soils of this State, notably those of the valleys, while rich in potash and lime, are very poor in phosphoric acid and sometimes in nitrogen. In sections where irrigation can be practiced, potash and lime will frequently be supplied to the soil in considerable quantities by the irrigation waters; for analyses of the latter show them to contain appreciable amounts of these elements. Lime occurs in them in the form of gypsum (thus also replacing to some extent the sulphuric acid needed by the plant) and carbonate of lime; the potash is generally found as sulphate. Notwithstanding this, the soils' supply would soon be diminished and the replenishment would have to be made by fertilizers containing high percentages of *all* the ingredients which go to make up plant-food. No "special" fertilizer would answer the purpose.

If, on the other hand, the *leaves* and *stalks* are returned to the soil, the amount of mineral matter withdrawn is, comparatively speaking, very small, being only about 28 pounds of potash, 19 of lime, 11 of phosphoric acid and 58 pounds of nitrogen per acre. A strong soil could withstand such a small demand for a considerable length of time without showing an appreciable diminution of crops; and whenever fertilizers become necessary, it will probably be found that in California, phosphoric acid and nitrogen are the substances to be supplied. When the decorticated stalks *only* are returned to the soil, as might be the case if the *leaves* were sold to paper mills, as has been suggested, then about 68 pounds more of potash, 567 of lime, 77 of phosphoric acid, and 206 pounds of nitrogen per acre are taken away from the soil than would be the case were they, with the stalks, given back to the land.

Whether or not it would pay to sell the leaves is a financial question depending on the prices obtained for them, and upon that which would have to be paid, sooner or later, for fertilizers used instead.

Should the *stalk* not be used as a fertilizer, then the amount of potash permanently removed from the soil would be increased by 156 pounds, that of lime by 72, phosphoric acid by 68, and that of nitrogen by 106 pounds; quantities forming, with exception of lime, a large percentage of the total mineral matter withdrawn.

As regards the *manner* of returning the "offal" of the ramie plant to the soil, the following paragraph from Bulletin No. 90 will be of interest:

"It is hardly necessary to remind any intelligent farmer that only *strong* soils can be expected to produce, in one season, a crop of ten tons of dry stalks of *any* kind, and that few can continue to produce such crops for many years without substantial returns to the land, no matter how fertile originally; but there is no reason why the offal of the ramie crop—the leaves and stalk-trash—should not be regularly returned to the soil. The leaves can be, and are usually dealt with by stripping the stalk on the ground, leaving them where they grew. As to the stalks, it is true that with three or four cuts per season it will be difficult to deal with the large mass of refuse by spreading it on the stubble, although in the more northerly portions of the area of cultivation it may be desirable to use this material for protection against frost. But as the return must either be made, or fertilizers purchased, the proper mode of procedure will be to make compost-heaps of the trash and thus render it less bulky, and convenient for spreading on the stubble after the last cut. This, in the case of strong soils, is all that will be required to keep up production for a long time, although the raw fiber sold represents a larger proportion of the soil's plant-food than in the case of cotton, in which the return of seed and stalk will maintain production indefinitely on any soil capable of yielding a profitable crop. When *no* returns are made, ramie will prove even a more exhaustive crop than is cotton when the seed is not returned, and those engaging in its culture had better understand from the outset that they can "rob the soil" with ramie even more effectually than with wheat."

COMPARISON WITH OTHER CROPS.

A comparison of the amounts of mineral ingredients withdrawn by the ramie with those removed by other crops will more forcibly show how a soil can be robbed by its continuous culture without returns being made. This is shown in table 3.

TABLE 3.

Amount, in pounds, of soil ingredients withdrawn from one acre by various crops.

	Potash.	Soda.	Lime.	Magnesia.	Br. oxide of Manganese.	Iron and Alumina.	Phosphoric Acid.	Sulphuric Acid.	Silica.	Chlorine.	Total.	Nitrogen.
RAMIE—												
Leaves, 4.25 tons	68.13	8.93	566.91	114.58	1.92	38.56	77.13	30.86	692.71	41.56	1641 35	206.10
Stalk (without bark), 7.25 tons	155.99	33.[illegible]3	71.77	43.68	1.45	12.16	67.71	14.53	7.06	2.50	410.48	105 85
Bark (cuticle and fiber), 2.75 tons	27 86	7.52	19.14	10 01	20	.71	10.86	3 17	4.48	7 79	91.74	57.75
Whole plant, 14.25 tons	251.98	50.14	657.82	168.27	3 57	51.43	155.70	48 56	704.25	51.85	21 3.57	369.70
HEMP—												
Leaves, 1975 lbs	56.46	.47	98.62	11.55	......	......	18.70	4.46	11.36	.34	......	......
Stems, 3,000 lbs	44.44	1.40	24.86	5.51	......	......	12.91	1.63	.75	.5	......	......
Clean fiber, 1000 lbs	.40	.08	7.22	.65	......	......	1.61	.05	.49	.01	......	......
Whole plant, 5975 lbs	101.30	1.95	130.70	17.71	......	.....	33.22	6.14	12.60	.86	......	62.74
FLAX—												
Straw, 1800 lbs	23.04	2.43	13.63	3.60	.18	76	7.87	4.02	1.60	2.26	59 39	18.00
Seed, 1724 lbs	20.60	1 19	5.80	9.75	.25	1.45	32.00	.07	.29	.04	71.54	56.54
Fiber, 600 lbs	.13	.30	3.27	.30	.....	.24	.72	.18	.31	.05	5 83	......
Whole plant, 4124 lbs	43.77	3.92	22.70	13.65	.43	2 45	40.59	4.27	2.23	2 35	136.46	......
COTTON—												
Leaves, 400 lbs	7.99	4.40	15.03	2.50	......	2.58	4.22	5.84	3.58	2 75	48.49	......
Stems, 1200 lbs	9.17	3.65	10.58	3.56	.....	.75	4.49	1.99	1.71	2.54	38 44	......
Seed, 800 lbs	8 99	1 15	3.07	4.00	......	.52	9.74	1.11	.31	.48	29.37	29.20
Burrs, 400 lbs.	7.42	4 59	14.16	3.19	.....	2.66	3.57	6.88	7.40	2.14	52.01	......
Lint, 400 lbs	1.69	.42	1.20	.46	......	.12	.52	.24	.08	.36	5.19	......
Whole plant, 3200 lbs.	35 26	14.21	44.04	13.71	......	6.43	22.54	16.0	13.08	8.27	173.40	......
WHEAT—												
Grain, 20 bu	7.85	.14	.72	2.57	......	.22	11.90	.34	.24	.02	24 00	24.00
Straw, 3[illegible]00 lbs	36.07	1.54	10.32	3.95	......	1.54	7.90	6.59	146.26	7.87	222.04	18.00
Whole plant, 4800 lbs.	43.92	1.68	11.04	6.52	......	1.76	19 8	6.93	146 50	7.89	246 04	42.00
SUGAR BEETS (fresh)—												
Roots, 40,000 lbs	152.00	24 00	16 00	24.00	......	3.00	36.00	12.00	8.00	12.00	287.00	60.40
Tops, 32,000 lbs.	235.44	198.48	208.08	171.60	......	13.68	80.16	68.04	36.96	49.68	1062.72	113.00
Whole plant, 72,000 lbs	387 44	222.48	224.08	195.60	......	16.68	116 16	80 64	44.96	61.68	1349.72	173.40

NOTE.—The data for the above table have, with the exception of that for ramie, been taken from the various station reports and bulletins.

Fiber Plants Compared with Ramie.

Of all the fiber plants ramie stands first as regards depletion of the soil of plant-food; a result which was to be expected from the greater mass of the plant harvested, since from three to four cuts can be made of the ramie, while only one each of hemp and flax is made. Taking average crops, hemp is second in total amount of ingredients removed, cotton third and flax fourth. Thus the total quantity of potash that is withdrawn by ramie is about 252 pounds, that by hemp 101 pounds, by flax 44, and 35 pounds by cotton. The corresponding figures for lime are: Ramie 658 pounds, hemp 131, flax 23, and cotton 44 pounds.

As regards the total amounts of phosphoric acid withdrawn, the ratio is somewhat altered in that flax *with seed* causes a severer drain in this respect than hemp, the figures in pounds being: ramie 156, flax 41, hemp 33, and cotton 23. It will be seen from a comparison of the above figures that when nothing is returned to the soil the depletion is less with cotton, so far as phosphoric acid and potash are concerned, than with either of the other fiber plants; and that the total amount removed by a good crop of ramie is more than the combined weight withdrawn by flax, hemp and cotton; illustrating again the impoverishing effect of this plant on the soil.

The total amount of nitrogen withdrawn by ramie is 370 pounds, which is about six times that removed by hemp and five times that by flax. The data at hand for cotton are insufficient for comparison of the *total* quantity carried off, but the seed takes away from the soil by far the greater part of the whole amount of nitrogen required by the cotton plant; hence it will be readily seen that ramie has a much more exhaustive effect on the soil than has cotton, with reference to this costly ingredient.

When the refuse materials for the different plants are returned to the soil, even then the ramie still stands first in depleting the soil of nitrogen; in fact, it removes 58 pounds against an insignificant amount by the fibers of the other plants.

If the seed, in the cases of cotton and flax, is sold in place of returning it to the soil, then flax and ramie bark carry away about the same amount of nitrogen, while cotton takes only one half that quantity.

If the soil is replenished by the "offal" or

refuse products of the several plants, viz.: returning all but the fibers, then, as regards *potash*, the quantity removed by ramie is 28 pounds, by cotton less than 2 pounds, .42 by hemp, and .13 pounds by flax. Were the seed in the case of cotton used otherwise than as a fertilizer, even then the amount would be only about 11 pounds, which is considerably less than one half of the figures for ramie. In other words, for the withdrawal of the same number of pounds of potash carried off by a single crop of ramie yielding 10 tons of dried stalks per acre, there would be required 16 crops of cotton, 66 of hemp and 214 of flax. The number of pounds of *lime* necessary for the ramie is 19, for hemp a little more than 7, for flax about 3.25, and 1.2 for cotton; or, making as before a comparison by crops, we have the result that one crop of ramie is equal in exhaustive power to 16 of cotton, about 2.5 of hemp, or to 6 of flax.

The *phosphoric acid* of the soil is drawn upon to the extent of 11 pounds for ramie, 1.6 for hemp, .72 for flax and .52 pounds for cotton; showing in regard to this as other ingredients that ramie causes the greatest strain on the soil.

When flax is grown for fiber *and* seed, then the relation between it and ramie, so far as soil exhaustion is concerned, is materially changed, inasmuch as that when the seed is sold, the potash permanently removed is 21 pounds (in place of .13 pounds when the seed is used in fertilization) or more than two thirds of the quantity required by the ramie. The phosphoric acid is also very much increased, and, instead of being less than one tenth, is then *three times* the amount withdrawn by ramie. In this case flax has a much more injurious effect on the soil than has ramie, because, although it uses up less lime and potash and about the same quantity of nitrogen, it draws much more heavily on phosphoric acid, which, as has been previously stated, is found in the soils of this State only in small proportions, there being on the contrary very generally an abundance of lime and potash.

Wheat vs. Ramie.

Comparing ramie to wheat, we find from the table that, when the leaves and stalks of the former are returned to the soil, the potash withdrawn by the bark is not nearly so much in amount as in the case of wheat, being about 28 pounds for ramie as against 44 for wheat. The phosphoric acid is not much more than one half that of wheat crop, the figures being 11 against 20. Hence, as regards these two elements of plant-food, wheat impoverishes the soil to a greater extent than does ramie.

Just the opposite conclusion is to be drawn when we compare the lime and nitrogen contents, particularly so in reference to the latter, which is taken from the soil to the extent of 106 pounds in the case of ramie, as against 42 for wheat; the proportion for lime is as 19 is to 11 pounds.

If nothing of the ramie "offal" is used as fertilizing material, then the soil is robbed much more effectually than is done by wheat, and in the ratios indicated by the following figures: Potash, 252 to 44; phosphoric acid, 156 to 20; lime, 658 to 11; nitrogen, 370 to 42.

Sugar Beet vs. Ramie.

The data given in the table for the sugar beet will be of special interest to the farmers who are now raising them or who contemplate so doing.

The amount of potash removed by a 20 ton crop of roots is 152 pounds, and by the tops 235. Of phosphoric acid, 36 by the roots and 80 pounds by the tops. A still greater difference is shown in the case of lime, the roots drawing on the soil to the extent of 24 pounds as against 195 for the tops, or more than eight times as much. The nitrogen in the tops is nearly double that found in the root, as indicated by the figures 113 and 60.

A careful consideration of the above will at once show the great benefit to be derived from, and the absolute necessity of returning to the soil the sugar beet tops; which, fortunately, is almost always done in practice.

It is readily seen from the table that the cultivation of the sugar beet, when the tops are *not* returned to the land, will impoverish the soil in potash, in a much shorter time than is the case with ramie, even when the entire plant is removed.

As regards the other costly ingredients, phosphoric acid and nitrogen, it will be seen that the ramie plant as a whole draws much more heavily on both than does the beet, and in the case of lime the difference reaches the proportion of nearly 3 to 1. When, however, all but the bark is returned in the case of ramie, and in that of the beets all but the root, the amount of potash taken away from the soil by beets is 152 pounds, or equal to about five-times that by the ramie. The diffierence is not very marked in the case of lime, ramie requiring 19 pounds and the beets 16. The same can be said concerning the nitrogen, for which ingredient the figures are 106 and 113; whereas the phosphoric acid in the beets, 36 pounds, is nearly 3.5 times that of the ramie. It thus appears that when in beet culture the tops are returned the draft upon the soil is on the whole much heavier than in the case of ramie, as it requires so much more potash and phosphoric

acid, while the amount of nitrogen is about the same in each.

Fruits vs. Ramie.

Owing to the insufficiency of the data at hand a comparison of ramie with the fruits, as regards the total amount of mineral matter withdrawn by the different crops of the latter, cannot be made; but those quantities can be compared which are permanently removed in each case, as shown in table 4.

TABLE 4.

Quantities of soil ingredients withdrawn by various fruit crops compared with ramie bark and fiber.

FRESH FRUIT	Total ash, lbs	Potash lbs.	Phos acid, lbs	Nitrogen, lbs.
Grapes Crop of 10,000 lbs per acre	89.00	50.00	15.20	17.00
Oranges (California) Crop of 20,000 lbs. per acre	86.40	40.14	10.60	36.60
Pears Crop of 20,000 lbs. per acre	66.00	36.00	10.00	12.00
Plums Crop of 30 000 lbs. per acre	87.00	51.60	13.20	167.70
Apples Crop of 20,000 lbs per acre	44.00	16 00	6.00	12.00
Ramie Bark (dry). Crop of 5,500 lbs, per acre	91.74	27.86	10.86	57.75

It will be seen, as regards total mineral matter, that while that of the ramie does not differ materially from that of grapes, oranges or plums, it has a trifle more than double that of apples and about 1.4 times of pears. Its content in potash is not much more than one-half that found in grapes and plums, considerably less than in the case of oranges and pears, but is 1.75 times that of apples. The phosphoric acid percentages are almost identical in the ramie bark, orange and pear; grapes and plums, containing, respectively 50 and 30 per cent more than does the ramie; while apples have only about 60 per cent of that amount.

In nitrogen contents ramie stands second to plums. Grapes carry off a little less than one-third, oranges about three-fifths, and pears and apples somewhat more than one-fifth of that removed by the ramie.

On the whole, then, ramie culture when all "offal" is returned, is fairly comparable to the less exhaustive fruit crops; but without such return it must be classed among the most exhaustive cultures known.

Berkeley, Sept. 23, 1891. M. E. JAFFA.

THE FERTILIZING VALUE OF GREASEWOOD.

A quantity of the dry brush of the greasewood plant (*Sarcobatus vermiculatus*) was furnished by George W. Raymond of Miramonte, Kern county; the object being to determine whether or not it would pay to use the plant, or its ash, as a return to the soil, or in making composts for general purposes of fertilization.

The table below shows the result as obtained by Assistant Jaffa, alongside of the ash analyses of some other well-known plants, for comparison:

Table showing ash composition of greasewood, compared with other plants.

	Greasewood	Samphire.	Seaweed. Fucus vesiculosus.	Seaweed. Laminaria digitata.	Cabbage.	Timothy hay.
Silica	11.81	2.6	1.7	1.6	1.2	35.6
Potash	18.53	36.4	14.5	22.4	48.6	28.8
Soda	39.45		24.0	24 1	3.9	2.7
Lime	1.36		13.9	11.9	15.3	9.3
Magnesia	1.09		9.5	7.4	3.3	3.6
Peroxide of iron and alumina	7.06		1.1	.6	......	......
Phosphoric acid	3.51		3.1	2.6	15.8	10.8
Sulphuric acid	4.93		24.0	13.3	8.5	3.9
Chlorine	15.30		10.1	17 2	2.5	5.0
	103.04		101 9	101 1	99.1	99.7
Less excess of oxygen due to chlorine	3.25					
Total	99.79					
Ash percentage of plant	12.03		14.4	18.6	10.8	7.0

It will be noted that of all the plants here shown, among which are three (samphire or "salt grass," and the two seaweeds) presumed to contain unusually large percentages of soda, the greasewood shows the largest amount of sodium salts; nearly 40 per cent of the ash being soda, out of which over 25 per cent of common salt, and nearly 8 per cent of Glauber's salt are formed. There remains out of the total amount shown in the analysis, 23 per cent that will go toward forming carbonate of soda, increasing its weight to about 39 if returned to the soil. This means that out of 100 pounds of greasewood ash, 72 pounds would be "alkali" of the usual composition of "black alkali;" which would at the very least be of no use to any soil, while to those already charged with alkali it would be decidedly detrimental, as adding so much to the evil already existing.

It is true that there is 18 per cent of potash and 3½ of phosphoric acid to be placed to the credit of the ash, as available and valuable plant food. But as potash is usually abundant already in the soils upon which the greasewood grows, this would hardly outweigh the disadvantage of the alkali in the same soils. Practically the 3½ per cent of phosphoric acid alone is to be written to the credit of the greasewood ash where it would usually be convenient to apply it; against the disadvantage of a returning three-fourths of the whole ash in the useless or detrimental form of "alkali."

The question still remains, how much of the other important fertilizing element, nitrogen, would be applied by the *fresh* plant. This has not as yet been determined; when it is, it may turn out that on well drained soils not too rich in alkali, the use of fresh or dried (but not of burnt) greasewood brush would be advantageous.

On the other hand, it may asked whether in clearing greasewood land, it would not be an advantage to remove the brush, so as to diminish the alkali; as is done when beets are planted in saline soils.

The fresh plant, including stems and leaves, may be estimated to contain about 75 per cent of water. A ton of the fresh brush would thus contain 500 pounds of dry matter, of which 60 pounds would be ash; and of this ash, about 45 pounds would be true, useless "alkali."

If, then, the ground were so thickly overgrown with the greasewood as to furnish about 10 tons of brush per acre, to remove that brush would be equivalent to taking away something like a quarter of a ton of alkali. This is not an insignificant amount in soils liable to injury from the excess of salts; and if the process were repeated several times, the greasewood would serve, like the beet, to remove a very notable proportion of the total alkali salts present in the soils; just as does the removal of samphire in reclaiming salt-marsh lands. On the other hand, were the greasewood growth only scattering, its removal would serve no

practically important object.

Comparing greasewood with the other plant ashes in the table. it will be seen that while it does not agree closely with any of these, it approaches the seaweeds more closely than the samphire. in its contents of potash and phosphoric acid. Seaweed is freely used for preparing fertilizing composts in countries where summer rains prevail; and usually on the sandy seashore soils, through which the excess of saline matters (sodium salts) is readily washed into the sub-drainage, and consequently does not stay to increase the salts in the soil, as would be the case in our arid climates. It will be noted that they, also, supply considerable potash, much needed in rainy countries; but only a small proportion of phosphoric acid, upon which the food and forage plants draw so heavily; as is seen in the annexed analyses of the ashes of cabbage and timothy hay. Phosphatic ferilizers are, therefore, needful in connection with the use of seaweed (and greasewood) composts, in order to supply the demands of the common culture plants.

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